

to Eastport, Me. A maximum wind velocity of 64 miles an hour was registered at New York, N. Y., and 56 miles at Block Island, R. I., Atlantic City, N. J., and Cape Henry, Va.

Another severe storm moved eastward over the Lake region during the 31st attended by gales throughout the Lake region and along portions of the Middle Atlantic and North Atlantic coasts. The highest velocity reported was 80 miles an hour from the southwest at Buffalo, N. Y. Ample warnings were issued in connection with this storm.

*Cold-wave warnings.*—No cold-wave warnings were issued or required, except for very limited areas, until the 21st, when a disturbance of considerable intensity over the North Atlantic States and the lower St. Lawrence Valley was followed by a decided increase in pressure and a marked fall in temperature over Ontario and the Lake region and cold-wave warnings were ordered for New England, New York, Pennsylvania, New Jersey, Delaware, Maryland, and the District of Columbia. These warnings were fully verified.

During the 23d–24th a disturbance moved rapidly eastward over the Lake region and the Northeastern States and it was followed by rapidly rising pressure and much colder weather, and cold-wave warnings were ordered for the Lake region, the Ohio Valley, Tennessee, the East Gulf States, northern New England, and northern and central New York. These warnings were only partially verified.

During the last two days of the month there was marked activity in the movement of areas of low and of high pressure accompanied by marked fluctuations in temperature over northern sections east of the Rocky Mountains. Cold-wave warnings were ordered for New England, New York, New Jersey, eastern Pennsylvania, and northern Michigan on the evening of the 28th and the morning of the 29th, and for northern Vermont and extreme northern New York on the evening of the 31st.

*Frost warnings.*—Frost warnings were issued on the following dates for portions of the South Atlantic and East Gulf States: 4th, 5th, 6th, 9th, 10th, 17th, 18th, 25th, 26th, and 31st. However, no frost warnings were issued for southern Florida during the month.—*C. L. Mitchell.*

#### CHICAGO FORECAST DISTRICT.

With the exception of advices issued to the stock interests in Nebraska and Wyoming on the morning of December 2, no special warnings were ordered from the Chicago Forecast District until the middle of the month. Following the storm which necessitated the issuance of stock warnings on the above date, the weather throughout the district until the 15th was dominated by an area of high pressure which persisted over the Plateau region, thus causing generally fair weather with temperature considerably above normal.

By the 15th, however, a depression had formed over the middle Rockies with much colder weather and high pressure to the north and northwest. On the 15th and 17th, cold-wave warnings were issued for portions of the northern Rocky Mountain region.

However, the first severe cold of the present season, accompanied by an area of strong high pressure, did not appear in the Northwest until the morning of the 18th and during the period from the 18th to 20th, spread slowly eastward and southward over the district, warnings being issued in advance in connection with its movement. Advices to stock interests in the northern Rocky Mountain

region and the Plains States were issued on the 18th and 19th.

On the morning of the 22d another HIGH appeared in the Canadian Northwest and during the 23d and 24th moved eastward and southward, warnings during this period being issued only for the eastern portion of the district. On the 23d, stock advices were issued for Nebraska, Kansas, and southern Wyoming.

On the 28th cold-wave warnings were issued for eastern North Dakota and northern Minnesota, following the movement of a disturbance of moderate intensity across the northern Lake region.—*E. H. Haines.*

#### NEW ORLEANS FORECAST DISTRICT.

On December 1, southeast storm warnings were displayed from Port Arthur to Velasco, Tex., and small-craft warnings from Velasco to Brownsville, because of squally conditions in a trough of low pressure which extended from the upper Mississippi Valley to Texas. Another depression was centered over the Texas Panhandle on the p. m. map of the 2d and southeast storm warnings were ordered on the east coast of Texas. A large high-pressure area was moving down over Texas on the p. m. of the 3d, and northwest storm warnings were ordered for the Texas coast, Port Arthur to Velasco. These warnings were verified.

On the morning of the 8th, northwest storm warnings were displayed from Port Arthur to Velasco and small-craft warnings on the remainder of the Texas coast because of an area of high pressure advancing southeastward in the rear of a disturbance over Louisiana. Fresh winds prevailed during the day.

Small-craft warnings were displayed on the Louisiana and Texas coasts at 8:20 a. m. (Central Time), on the 17th, for strong northwest winds diminishing at night. The wind was already strong at the time the warning was issued and diminished during the afternoon.

Small-craft warnings were displayed on the Texas coast on the 23d, and northwest storm warnings were issued for the east coast of Texas at night on the 23d. The next morning the storm warning was extended over the remainder of the Texas coast and small-craft warnings were displayed on the Louisiana coast. Winds occurred as forecast.

Small-craft warnings were displayed on the Texas coast on the 31st and were justified.

Advices were issued on the 8th, 17th, and 25th, to interests represented in Tampico, Mexico, for strong northerly winds to moderate gales, and on the 25th for Progreso, Mexico.

Cold-wave warnings were issued at 8:40 p. m. of the 2d, for northwestern Arkansas, Oklahoma, and northern Texas, and were repeated next morning except for the northern portion of west Texas. The warning was fully verified in Oklahoma and at Abilene, Tex., and a decided fall in temperature occurred in the remainder of the territory warned.

Cold-wave warnings issued at 8:40 a. m. of the 16th, for Oklahoma and northwestern Texas, and on the 17th for Port Arthur, Tex., were justified.

Cold-wave warnings issued 8:45 p. m. on the 18th, for Oklahoma, were repeated and extended on the 19th to northwestern Arkansas and the northwest portion of east Texas, were repeated again at 8 p. m.; and on the 20th they were repeated, 9 a. m., and extended over Arkansas and the northern portion of east Texas; a coal wave occurred in Oklahoma, and much colder prevailed in other portions of the district covered by warnings.

Cold-wave warnings were issued for Oklahoma, 8:30 p. m. of the 22d, and repeated and extended to extreme northwestern Arkansas at 9 a. m. of the 23d, and were extended at 3 p. m. over Arkansas and the interior of Texas, and were repeated at 8:30 p. m. for Arkansas and Dallas and Palestine, Tex.; the warning was extended at 9 a. m. of the 24th to the coast; these warnings were generally justified.

Frost or freezing warnings were issued for portions of the southern part of the district on the 4th, 5th, 8th, 9th, 10th, 17th, 25th, and 31st. Fire-weather warnings were issued on the 3d, 19th, and 23d.—*I. M. Cline.*

#### DENVER FORECAST DISTRICT.

With the exception of a storm which appeared over Idaho on the afternoon of the 1st and moved rapidly southeastward across the district, the first half of the month was characterized by settled weather, under the influence of high pressure in the Plateau region. During the latter part of the month low pressure and unsettled weather prevailed west of the mountains, while a succession of cold anticyclonic areas occupied the northeastern slope.

The storm which appeared over Idaho on the afternoon of the 1st moved rapidly southeastward, overspreading both slopes of the Rocky Mountains by 8 a. m. of the 2d, with barometer readings more than 0.5 inch below the normal. The disturbance was followed by an unusually sharp rise in pressure in the North Pacific States. Warnings of a moderate cold wave were issued for Utah, northern and western Colorado, northern Arizona, and northwest New Mexico on the 2d. The temperature fell 10° to 16° in the greater part of Colorado and New Mexico and was well below the freezing point. The coldest weather following the storm did not occur, however, until the morning of the 4th, when the readings in the greater part of the area for which warnings were issued ranged from 2° to 14° above zero. An area of low barometer developed in the northern Rocky Mountain region on the 15th, being central at 8 p. m. in northeastern Colorado. Cold-wave warnings were issued for eastern Colorado. The warnings were justified, the prevailing temperatures ranging from zero to 14° above zero on the morning of the 17th. A cold wave also occurred in northeastern Arizona, extreme southwestern Colorado, and parts of New Mexico.

Another area of low pressure of considerable intensity appeared over Nevada on the 18th, with an area of high pressure over Alberta. Cold-wave and live-stock warnings were issued for eastern Colorado and extreme eastern New Mexico. Although the anticyclonic area moved very slowly southward and eastward, the western disturbance remained central on the Pacific coast, having apparently recurved to the northeastward before reaching the coast. While the falls in temperature were not great, colder weather prevailed in eastern Colorado, with temperatures ranging from 5° to 20° above zero on the mornings of the 19th and 20th. Unsettled weather, with local rain or snow, prevailed in Utah, western Colorado, and northern Arizona from the 18th to the 23d under the influence of this disturbance. On the evening of the 22d another cold anticyclonic area was overspreading the northeastern slope, while the western disturbance had apparently concentrated as a deep center of depression in southwestern Utah. Warnings of a cold wave were distributed for Utah, Colorado, northern Arizona, and northern and eastern New Mexico, and

heavy snow for Utah, Colorado, northeastern Arizona, and northern New Mexico. Heavy snow occurred in parts of Utah and Colorado and a cold wave in the greater part of the area for which warnings were issued. Zero temperature was reported on the morning of the 24th at Flagstaff, and the temperature was 6° to 8° below zero in northeastern Colorado. A cold-wave warning issued for southeastern and extreme eastern New Mexico on the morning of the 24th was followed by a sharp fall in temperature with readings close to 20° above zero in southeastern New Mexico. Heavy snowfall warnings were issued for Utah and northern Arizona on the morning of the 25th, an area of unusually low pressure having appeared on the middle Pacific coast. The disturbance decreased in intensity, however, and failed to move inland. Moderate to heavy precipitation was confined to western and central Arizona.—*Frederick W. Brist.*

#### SAN FRANCISCO FORECAST DISTRICT.

The pressure distribution controlling the weather over the Pacific Slope during December, 1921, was of two entirely different types, and each covered practically one-half of the month. During the first portion of the month the pressure was low over Alaska, the British possessions and the north Pacific Ocean and high over the southern Plateau, California, and the ocean to the west and storms from the north Pacific entered the continent at a high latitude. This is the typical distribution for fair weather in California and the Plateau, light rain in western Oregon and seasonable rain in Washington.

The latter part of the month presented a complete reversal of the pressure distribution. A large sluggish area of high pressure covered Alaska, the British possessions, North Pacific Ocean, and Rocky Mountain region, and caused storms from the ocean to be forced far south of their usual path and enter the continent through California. This is the typical condition for heavy precipitation over California and the Plateau. Hence, the first part of the month gave moderate precipitation in western Washington and northwestern Oregon, and the latter part heavy precipitation in California and the Plateau region.

The storm from the 18th to the 27th did a large amount of damage to highways, bridges, and railroads in southern California by floods, washouts, and landslides. The gale on the 25th in the San Francisco Bay section prostrated telegraph and telephone lines, uprooted many trees, unroofed several houses, and interfered with the ferry services on the bay. On the 20th, while about 900 miles off the California coast en route to Honolulu, the Japanese freighter, *Texas Maru*, was severely damaged by gales and high seas and the first and third officers were washed overboard.

Storm warnings were ordered 15 times, small craft 2, and advisory warnings 4. Frost warnings were issued in California 9 times and a cold-wave warning in eastern Washington and northern Idaho on the 18th.—*G. H. Willson.*

#### 627.41(73) RIVERS AND FLOODS.

By H. C. FRANKENFIELD, Meteorologist.

Mention of the Ohio River flood of late November and early December was made in the MONTHLY WEATHER REVIEW for November, but no data were given for points south of Mount Vernon, Ind.